# Benefits of Fish Oil in Human Health

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**Abstract.** This review examines the health impacts of fish oil on the human body. Fish oil contains two omega-3 polyunsaturated fatty acids (PUFAs), which are called eicosapentaenoic acid (EPA) and eicosapentaenoic acid (DHA). It is believed that omega-3 fatty acids have many metabolic functions. Through existing research and studies, the relationships between fish oil consumption and the prevalent diseases are investigated. A review of the literature indicates a general agreement that fish oil could be beneficial in mitigating breast cancer metastasis and reducing prostate cancer risk. In addition, the potential of fish oil in taking care of cardiovascular diseases, stroke, neurological injuries, and inflammatory diseases like rheumatoid arthritis (RA) are examined based on historical observations and contemporary clinical trials. This paper is based on primary and secondary research offering a comprehensive understanding of the benefits of fish oil. The results emphasize the importance of fish oil and advocate for consumption of fish oil on a daily basis.

**Keywords:** Fish oil, Omega-3 Fatty Acid, Cancer, Stroke, Cardiovascular disease.

## 1. Introduction

Fish oil is extracted from fatty or oily fish, such as tuna and salmon. The two omega-3 fatty acids found in fish oil, EPA and DHA, are thought to offer some health benefits. Wet processing techniques are frequently used to extract fish oil. The techniques use heat to force the release of oil from the oily fish. Then the oil is purified by gravity and other processes to separate the effective components [1]. Fish oil has been used as a dietary supplement since 1850. As cases of illnesses such as stroke, cancer, and arthritis continue to increase in modern society, there is a growing interest in exploring potential remedies. Fish oil has emerged as one of the avenues worth investigating in this situation. Since the last century, many tests and studies have been conducted on fish oil in treating different diseases, and many scientists conclude that decreased consumption of fish or omega-3 fatty acids during the past decade in various countries leads to higher incident of cancer and strokes [2]. This comprehensive review of the literature explores the effects of fish oil on cancer, cardiovascular diseases, stroke, and neurological injury. In examining these areas, varying outcomes emerge, sometimes contradicting one another. For instance, while historical observational studies suggest an inverse correlation between fish oil and cardiovascular diseases, recent trials revealed that there is no significant relationship between these two. Despite of this controversy, this review aims to discuss the diverse impacts of fish oil on health, advocating for further exploration and understanding of its mechanisms.

## 2. Fish Oil and Cancer

Cancer refers to body cells which grow abnormally and have the ability to spread to other parts of the body and destroy body tissues. Chandi Charan Mandal's group and A E Norrish's group both suggested that fish oil consumption could positively affect breast cancer and prostate cancer [3,4].

Chandi Charan Mandal and his group investigate the potential relationship between fish oil consumption and breast cancer. The study conducted experiments on mice that were injected with breast cancer cells. Mice that consumed fish oil exhibited significantly reduced osteolytic bone destruction compared to the control group, which indicates suppression of cancer cell metastasis to bone [3]. This phenomenon is due to both DHA and EPA being found to stop breast cancer cells from spreading. In addition, mice fed with fish oil were found to have relatively low CD44, a cell adhesion protein associated with metastasis, in their breast cancer cells [3]. The decline of CD44 and the fact that breast cancer cells stop spreading after consuming fish oil reveals the fact that EPA and DHA

are effective against the invasiveness of breast cancer cells and reduce potential osteolytic bone destruction.

On the other hand, based on the data from the Auckland Prostate Study, a population-based control research involving male residents between the ages of 40 and 80 from Auckland, AE Norrish et al. found the relationship between omega-3 fatty acids and the risk of prostate cancer [4]. This study involved 317 individuals diagnosed with prostate cancer and 480 community controls matched for age. The study found that the concentration of DHA and EPA in erythrocytes showed an inverse correlation with the risk of prostate cancer. Norrish et al. argue that EPA and DHA might inhibit the spreading of prostate cancer cells through the modulation of eicosanoid biosynthesis. Another study done by Rose et al. found similar results. The study demonstrates that when exposed to long-chain omega-3 fatty acids, such as EPA and DHA, human prostate cancer cell showed slower rates of cell growth and slower generation of eicosanoid [5].

The results found by these studies show the potential inhibitory effect that fish oil has in breast and prostate cancer treatments. However, further research is required to determine the precise mechanism and how omega-3 fatty acids interact with cancer cells.

## 3. Fish Oil and Cardiovascular Diseases (CVD)

Even though the relationship between fish oil and various heart conditions has been examined in many studies, the relationship remains controversial.

Stone's research examines several observational studies and clinical trials discussing the potential effect that fish oil has on coronary heart disease (CHD) prevention. It is mentioned that Greenland Eskimos' lower coronary mortality due to their diet rich in omega-3 fatty. A diet high in omega-3 fatty acids also lowers triglycerides, blood cholesterol, and other lipid markers [6]. Stone mentions some historical observational studies also show that fish consumption on a weekly basis, regardless of their race and country, is associated with a lower risk of cardiac death. However, Stone claims that this idea is controversial as different results emerged. The Health Professionals Follow-up Study failed to find any evidence linking higher omega-3 fatty acids intake to the prevention of CHD [6,7]. In addition, a clinical trial measuring the effect of fish oil treatment on normocholesterolemic men with CHD did not find correlation between fish oil and coronary artery diseases [8].

Ramashree's research summarizes other major studies' findings, emphasizing the lack of substantial benefits of fish oil [9]. Trials conducted by the VITAL research group suggest that fish oil cannot be used in the primary prevention of coronary artery disease. The trial involved nearly 26,000 healthy individuals who have never had coronary artery disease, and it took approximately 5.3 years to finish [9,10]. VITAL’s study questioned the protective effects of fish oil in reducing cardiovascular mortality.

While some historical observational studies have shown the potential benefits of fish oil in reducing CVD risk factors like cholesterol levels and triglycerides, the outcomes of large-scale clinical trials have often been inconclusive or conflicting [6,9]. This disparity shows the need for further studies on this debatable topic.

## 4. Fish Oil and Stroke

The relationship between fish oil and the risk of stroke has been studied by various research groups. Ecologic and cross-sectional studies have presented conflicting observations.

Hiroyasu investigates the connection between fish consumption and the risk of stroke subtypes in women. Hiroyasu cites the study conducted by Nurses’ Health Study. This study is a prospective cohort analysis spanning 14 years, followed by nearly 79839 women who have never had cancer, cardiovascular disease, diabetes, and hypercholesterolemia [11,12]. The key findings indicate a substantial inverse correlation between the risk of stroke, particularly thrombotic stroke subtypes, and fish consumption. Women who consumed fish more demonstrated a reduced risk of thrombotic

infarction. The study also shows that among women who didn't regularly take aspirin, higher intake of omega-3 fatty acids could lower the risk of total stroke and thrombotic infarction [11]. This study suggests potential mechanisms for this risk reduction, such as inhibition of platelet aggregation, decreased blood viscosity, and suppression of certain lipid mediators, among others [11,12].

Ka He's study shares a similar result that fish consumption leads to a reduced risk of stroke among men [13]. Over a 12-year period, the Health Professional Follow-up Study, involving nearly 44,000 men without cardiovascular disease at the beginning of the study, aimed to understand the correlation between fish consumption, omega-3 PUFA intake, and risk of stroke [13,14]. The findings revealed that regular fish intake on a monthly basis was associated with a lower risk of ischemic stroke in men. However, the reduction in risk did not continue to decrease with higher frequencies of fish consumption [13,14].

While both He's and Hiroyasu et al. suggest fish consumption reduces the risk of stroke, Henneken's review shows controversial results. Observations in Greenlandic Inuits showed a higher risk of hemorrhagic stroke due to high fatty fish intake [15,16]. However, a different study conducted in 36 nations found a negative correlation between the death from stroke and fish consumption [17]. Heenken claims that case-control and prospective studies yielded mixed results. While some case-control studies found fish oil effective against first-ever stroke and primary intracerebral hemorrhage, no direct relationship was found for ischemic stroke. Prospective studies showed varied outcomes; whereas some revealed a lower risk of stroke with increased fish diet, others found no connecting link between fish intake and stroke. Overall, Hennekens suggests that regular fish intake might reduce thrombotic stroke risk, and he recommends fish consumption for reducing stroke risks.

## 5. Fish Oil and Neurological Injury

Yuan Shi and his group conducted research seems to suggest promising results regarding the impact of fish oil on mitigating the effects of repetitive mild traumatic brain injuries (TBIs). The use of a novel fluid percussion rat model allows for the observation of cognitive impairments and loss of brain tissues [18]. The study uses two group of rats as comparison, one fed an experimental diet rich in omega-3 fatty acids and one control group. The similarity in calorie, oil, and nutrient quantities between the diets helps isolate the effect of fish oil on the observed outcomes.

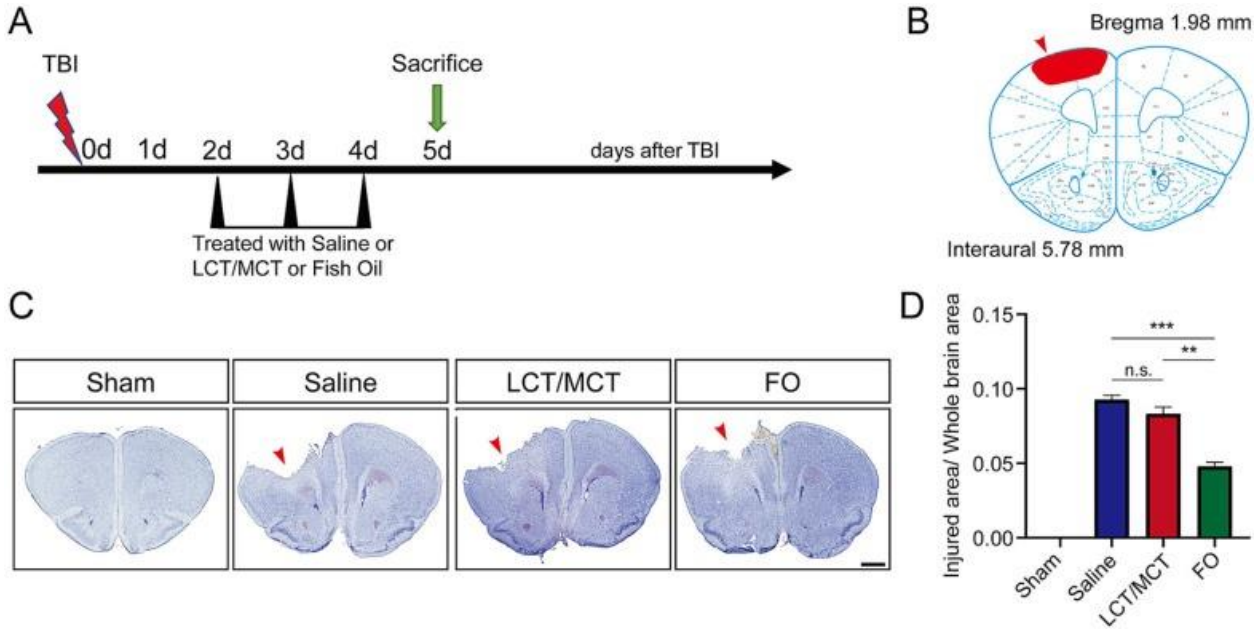



**Fig. 1** The traumatic brain damage rats were treated with fish oil. On day 5, it showed reduced brain injury. (A) experimental design: TBI mice were treated with fish oil on day2,3,4. (B) A brain segment diagram showing the location of the TBI. (C) Evaluation of how many brains tissues each group lost [19]

As shown in Fig.1, Shi's group accessed the total brain tissue lost at the 5-day mark post-TBI. When compared to the other two groups, the group treated with fish oil showed a substantial reduction. Moreover, the brain lesion volume in the group treated with fish oil was notably smaller compared to the LCT/MCT treated mice. These findings strongly suggest the neuroprotective effects of fish oil on TBI affected brain tissue.

## 6. Conclusion

Fish oil or omega-3 acids shows potential in mitigating breast cancer metastasis and reducing prostate cancer risk, as indicated by various studies. However, uncertainties persist regarding its effects on cardiovascular diseases, stroke, and neurological injuries. While some historical and observational studies suggest positive correlations between fish oil intake and reduced cardiovascular risks, recent clinical trials often present conflicting or inconclusive results.

The relationship between fish oil and stroke risk remains ambiguous, with studies found various outcomes. While some suggest a reduced risk associated with increased fish consumption, others present the opposite observations, emphasizing the need for further investigations.

Regarding neurological injury, fish oil is found to have promising neuroprotective effects in mitigating traumatic brain injuries. However, this area necessitates deeper exploration to establish definitive conclusions.

The main problem scientists face when exploring the health effects of fish oil is that it takes years for a clinical trial to be done. This might lead to the controversial results presented by historical observational studies and recent clinical trials. Despite the fact that it remains unclear whether fish oil is effective in common disease treatments due to the controversial outcomes, the benefits of fish oil present a compelling reason for its incorporation into daily dietary or supplementation. As a suggestion, considering oral intake of fish oil as a daily supplement or inclusion in the diet is a prudent step toward better health outcomes.

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